CENTRAL INTELLIGENCE AGENCY

INFORMATION REPORT

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SUBJECT	The Solubility of Chemical Elements in Chromium
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1. Izvestiya Academii Nauk SSSR, Otdeleniye Khimichnii Nauk, 1953, No 6, Page 980. "The Solubility of Chemical Elements in Chromium" by I I Kornilow.

   a. "Research on chromium alloys is of great significance since these alloys have wide use in industry. More possibilities for their use will be found in the future."

   b. Purely theoretical argumentation and practical experiments enabled the author to arrive at the following conclusions:

      (1)"Solubilities of the elements in chromium showed analogical ranges to the solubilities of said elements in others such as iron, nickel, copper, etc.

      (2)"Creation of hard chromium alloys with other elements or the impossibilities of such, is based entirely on the Mendelyeev periodic law.

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(3)"Thanks to the aforementioned there are real possibilities of foreseeing whether or not various elements will combine with chromium or hard alloys.

(4)"Conclusions consequent upon the crystallographic laws lead to the same possibilities of determining whether or not the aforementioned elements will be suitable as components of hard alloys with chromium.

(5)"The inference can be drawn that chromium may be combined as a continuous alloy with titanium (high temperature β modification), with vanadium, molybdenum, and wolframium, but only as a non continuous alloy with beryllium, boron, zirconium, hafnium, uranium, rhenium, and with all elements belonging to the VIII group (iron and platinum group) excluding Iron-A of an isomorphic structure with chromium. With this kind of iron chromium can be combined as a continuous alloy.

(6)"Metallic elements, members of the first and second groups possessing basic qualities which are separated considerably from chromium (excluding only beryllium) and which vary a great deal from chromium insofar as atomic diameters are concerned, are unable to combine with chromium alloys either as liquids or as solids.

(7)"The contemplation of solubility of various elements with chromium strengthens the possibilities of creating more complicated triple, quadruple, etc. solid hard solutions.

(8)"Particulars concerning the solubility of the elements in chromium such as double, triple, quadruple, etc. enable determining the possibilities of obtaining more or less simple compositions of chromium alloys based on continuous or discontinuous hard solutions of chromium.

(9)"Definite findings related to the solubility of various elements in chromium lead to the problems of alloys strictly related to the chromium elements, namely, molybdenum and wolframium. Some laws proved by prepared chromium alloys should be confirmed in practice by successful alloys based on molybdenum and wolframium."

c. Comment and Evaluation

(1) In general use of chromium, particularly in the manufacture of steel products, requires many ferrous and non ferrous alloys. Stainless steel is essentially a ferro-chrome alloy. In the chemical industry the alloy generally consists of iron and 13 percent chromium.

(2) An electronic theory for the development of passivity in a chromium-iron alloy states that an electron in the "S" level of the iron migrates to the available "D" level which can accomodate five electrons of the chromium atom, and that this adjustment is the source of the passivity or non-attack by acid. The theory permits an estimation of the amount of alloying element the iron alloy should have, and the estimate agrees closely with the alloys used in practice.

(3) In the research carried out by the Soviet scientists [redacted] the implications are much greater than the conclusions which they state. [redacted] their work in iron-chromium alloys is done in connection with requirements that the Soviet State may have served on the chemical industry of that country. [redacted] the experiments are essentially concerned with developing a sturdy material which will resist hydrochloric and hydrofluoric acid.

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(4) [redacted] Soviet industry is seeking a suitable material which will eliminate corrosion. The general tone of the article would indicate that the industries concerned with the development of a preventative for corrosion are: 25X1

(a) Those industries concerned with substitution of Haloid materials

(b) The dye industry

(c) The pharmaceutical industry

(5) The processes employed in the above experiments are by and large standard procedures and are well known to chemists who deal with corrosion.

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[redacted]

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